



(19)

Europäisches Patentamt
European Patent Office
Office européen des brevets



(11)

EP 0 844 706 A3

(12)

EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
03.02.1999 Bulletin 1999/05

(51) Int. Cl.⁶: **H01S 3/06**, **H01S 3/0941**,
H01S 3/25

(43) Date of publication A2:
27.05.1998 Bulletin 1998/22

(21) Application number: 97119091.3

(22) Date of filing: 31.10.1997

(84) Designated Contracting States:
**AT BE CH DE DK ES FI FR GB GR IE IT LI LU MC
NL PT SE**
Designated Extension States:
AL LT LV RO SI

(72) Inventors:
• Edagawa, Noboru,
c/o Kokusai Denshin Denwa K.K.
Shinjuku-ku, Tokyo (JP)
• Akiba, Shigeyuki,
c/o Kokusai Denshin Denwa K.K.
Shinjuku-ku, Tokyo (JP)

(30) Priority: 21.11.1996 JP 310508/96

(71) Applicant:
Kokusai Denshin Denwa Kabushiki Kaisha
Tokyo 163-03 (JP)

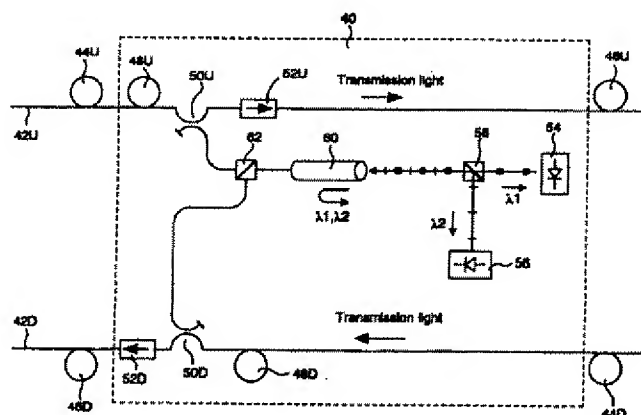
(74) Representative:
Schaumburg, Thoenes & Thurn
Postfach 86 07 48
81634 München (DE)

(54) Optical amplifier and laser light generating apparatus

(57) In order to prevent two pumping lasers (54,56) from overlapping in oscillation wavelength due to injection locking by return light in a apparatus using double pumping lasers, the apparatus is configured to enter optical outputs from the pumping lasers into a fiber grating (60) using a PANDA fiber through a half mirror and to reflect them back to the pumping lasers. The fiber grating has two main axes whose reflective wavelengths λ_1 , λ_2 are different only by approximately 0.4 nm, and

locks the laser oscillation wavelength of one of the pumping lasers to the wavelength λ_1 and the laser oscillation wavelength of the other pumping laser to the wavelength λ_2 . Light passing through the fiber grating is entered into erbium-doped optical fibers (48U,48D) through a 3 dB coupler and WDM couplers (50U,50D) to excite the erbium-doped optical fibers.

Fig. 1

**EP 0 844 706 A3**



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 97 11 9091

| DOCUMENTS CONSIDERED TO BE RELEVANT | | | |
|--|--|--|--|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int.Cl.8) |
| P,X | GB 2 306 245 A (MITSUBISHI ELECTRIC CORP) 30 April 1997 * abstract * * page 32, line 10 - page 35, line 1 * | 1-10 | H01S3/06 H01S3/0941 H01S3/25 |
| X | EP 0 730 328 A (ALCATEL NV) 4 September 1996 * abstract * | 1,3,9 | |
| A | US 5 457 568 A (JACOBVITZ-VESELKA GLORIA R ET AL) 10 October 1995 * column 2, line 6 - line 11; figure 1 * | 1 | |
| A | US 5 510 930 A (MOTOSHIMA KUNIAKI ET AL) 23 April 1996 * abstract * | 1 | |
| A | EP 0 541 061 A (MITSUBISHI ELECTRIC CORP) 12 May 1993 * claims 1,6; figures 12,14 * | 1,2 | |
| | | | TECHNICAL FIELDS SEARCHED (Int.Cl.8) |
| | | | H01S |
| The present search report has been drawn up for all claims | | | |
| Place of search THE HAGUE | | Date of completion of the search 4 December 1998 | Examiner Galanti, M |
| <p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p> | | | |

EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 97 11 9091

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

04-12-1998

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---------------------|----------------------------|---------------------|
| GB 2306245 A | 30-04-1997 | JP 9097940 A | 08-04-1997 |
| | | FR 2739502 A | 04-04-1997 |
| | | US 5760949 A | 02-06-1998 |
| EP 0730328 A | 04-09-1996 | FR 2731524 A | 13-09-1996 |
| | | CA 2170316 A | 29-08-1996 |
| | | DE 69600771 D | 19-11-1998 |
| | | JP 8254724 A | 01-10-1996 |
| | | US 5640268 A | 17-06-1997 |
| US 5457568 A | 10-10-1995 | NONE | |
| US 5510930 A | 23-04-1996 | JP 7038182 A | 07-02-1995 |
| | | FR 2708152 A | 27-01-1995 |
| EP 0541061 A | 12-05-1993 | JP 5235442 A | 10-09-1993 |
| | | JP 5292037 A | 05-11-1993 |
| | | JP 6006309 A | 14-01-1994 |
| | | JP 5136495 A | 01-06-1993 |
| | | DE 69220648 D | 07-08-1997 |
| | | DE 69220648 T | 18-12-1997 |
| | | EP 0652613 A | 10-05-1995 |
| | | EP 0712217 A | 15-05-1996 |
| | | EP 0768766 A | 16-04-1997 |
| | | EP 0778682 A | 11-06-1997 |
| | | US 5455704 A | 03-10-1995 |
| | | US 5367587 A | 22-11-1994 |

